wherein the spacer is formed by hardening a hardenable resin composition containing as the essential component a hardenable polymer obtained by reacting material polymer having ,a principal chain including at least a component unit having an acidic functional group and a component unit having a hydroxyl group with an isocyanate compound having a hardenable reactive group, and further reacting the same with an alcohol.

REMARKS

Please enter the amendments to Claims 1, 11, 22 and 35 as shown in the attached Appendix. Support for the amended claims is found in the specification on Page 73, lines 10-13 as filed. No new matter is believed added on entry of the amended claims.

Reconsideration of the rejection of claims 1-50 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 4,717,643 to Scheve, et al. is respectfully requested.

Scheve teaches a solder mask composition incorporating a binder material that is the reaction product of a polymerized mixture of polypropyleneglycol monomethacrylate, methacrylic acid and preferably other specific acrylates and methacrylates and (b) isocyanatoethyl methacrylate. The quantity of isocyanatoethyl methacrylate used to "endcap" the polymeric backbone is a molar amount equal to about 90% of the molar amount of the hydroxy-substituted monomers used to synthesize the backbone. This reaction is disclosed as generating foam equal to approximately 30-40% of the original reaction volume during the heating of the reaction mixture. The skilled artisan would be aware that the foaming is an indication of carbon dioxide liberation resulting from the reaction of a cyanide group with a acrylate acid group. Subsequently, the reference teaches that a small fraction of 2-

hydroxypropyl methacrylate (HPMA) is added to remove residual isocyanate via reaction of the remaining NCO group with the hydroxyl group. This mixture is then mixed with additional reactive components to form a solder mask composition.

In contrast to Scheve, et al., the instant invention comprises a highly stable polymer having a principal chain including at least a component unit having an acidic functional group and a component unit having a hydroxyl group wherein an isocyanate compound is amido-bonded with at least a portion of the acidic functional group via an isocyanate group of the isocyanate compound, and/or urethane with at least a part of the hydroxyl group via an isocyanate group of the isocyanate compound; and an alcohol is ester-bonded with at least a part of the acidic functional group via a hydroxyl group of the alcohol, and wherein the highly stable polymer contains substantially no acid anhydride groups.

Scheve nowhere teaches or suggests the formation of acid anhydride groups produced during the reaction of the isocyanate group containing-compound and subsequently decomposed on treatment with an alcoholic compound to provide the highly-stable polymer of the instant invention. Scheve only describes the addition of 2-hydroxypropyl methacrylate, to remove any residual isocyanate, thereby producing a moiety containing two unsaturations that can serve as a cross-linking agent in the final ultraviolet–induced polymerization of the solder mask composition. Scheve nowhere discusses or discloses amounts of remaining isocyanate methacrylate nor the amounts of 2-hydroxypropyl methacrylate consumed in Example 1. Finally, the disclosure in U.S. Patent 4,717,643 does not presume the existence of any acid anhydride group formed as a product or byproduct or whether they might be subsequently decomposed with any of the 2-hyroxypropyl methacrylate.

Accordingly, it is submitted that amended independent claims 1, 11, 22 and 35 are now distinguished and novel over Scheve, et al. and applicants respectfully request the 35 USC §102(b) rejection be withdrawn.

Claims 1-50 stand alternatively rejected under 35 U.S.C., §103(a) as obvious over Scheve U.S. Patent No. 4,717,643. Applicants respectfully traverse the rejection. There is no teaching in Scheve that the added hydroxypropyl methacrylate inherently reacts with any acid anhydride side product to produce an ester. Scheve, et al. clearly describes at column 4, line 26-28 that the 2-hydroxypropyl methacrylate is added to remove residual isocyanate. Thus, Scheve et al, teaches away from Applicant's invention. Further, Applicants respectfully disagree that the copolymer incorporating the half-acid esters resulting from decomposition of the anhydride groups is not distinguished over Scheve, et al. as he nowhere discloses the formation of such groups in his copolymer. Clearly, Scheve et al. doesn't recognize the source of the problem relating to copolymer instability nor the solution to the problem. Thus, the instant invention is non-obvious in view of Scheve et al. Accordingly, the independent claims 1, 11, 22 and 35 are allowable as amended. Corresponding claims 2-10, 12-21 and 23-34 which depend from the independent claims are therefore also allowable.

With respect to the rejection of independent claim 42 and dependent claims 43-50, over Scheve et al., Applicants respectfully traverse the rejection and believe these claims are novel and unobvious as filed over the cited reference to Scheve, et al., U.S. Patent 4,717,643 as the reference nowhere discloses under 35 USC 102 (a) nor suggests under 35 USC 103 (b) the sequence of steps in the claimed process.

Claims 8, 19, 32, 39, 44 and 48 stand rejected under 35 U.S.C. §112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

These claims contain typographical errors in the form of extraneous periods. The rejection is believed to be overcome by appropriate amendment: the claims have been written, removing the typographical errors.

Applicant's submit that on entry of the above amendments claims 1-50 are in condition for allowance and early notice is respectfully requested.

Respectfully submitted,

Attorney for Applicant(s)
Timothy J. Keefer
225 West Wacker Drive
Chicago, Illinois 60606
Reg. No. 35,567

Date: 8/7/02
Telephone: (312) 201-2327

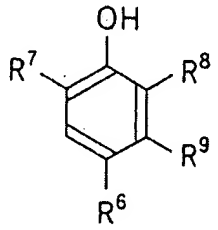
APPENDIX

MARKED UP VERSION OF AMENDED CLAIMS

1. (Amended) A highly stable polymer having a principal chain including at least a component unit having an acidic functional group and a component unit having a hydroxyl group wherein an isocyanate compound is amido-bonded with at least a pan of the acidic functional group via an .isocyanate group of the isocyanate compound anti/or urethane with at least a part of the hydroxyl group via an isocyanate group of the isocyanate compound, and an alcohol is ester-bonded with at least a part of the acidic functional group via a hydroxyl group of the alcohol, and wherein the highly stable polymer contains substantially no acid anhydride group.

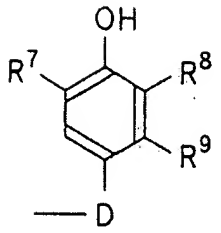
8. (Amended) The highly stable resin according to claim, 1 wherein the isocyanate compound is introduced in the principal chain part of the highly stable resin, using a polymerization inhibitor selected from the group consisting of a phenol-based compound represented by the below-mentioned formula (10) and a phosphite-based compound represented by the below-mentioned formula (6):

Formula (10)



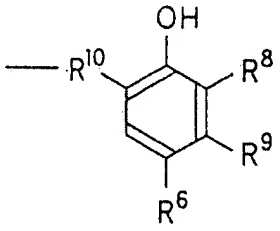
wherein R^6 is hydrogen, an alkyl group having 1 to 5 carbon atoms, or the below-mentioned formula (11):

Formula (11)



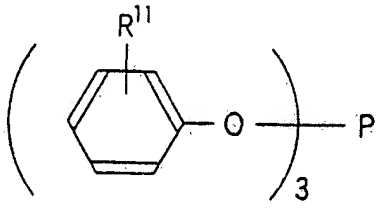
wherein D in the formula (11) is –S-, an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^7 is hydrogen or an alkyl group having 1 to 10 carbon atoms[.], R^8 is hydrogen, an alkyl group having 1 to 10 carbon atoms, or the below-mentioned formula (12):

Formula (12)



wherein R^{10} in the formula (12) is an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.] R^9 is hydrogen or an alkyl group having 1 to 10 carbon atoms[. H]however, at least one of R^7 and R^8 is a tert-butyl group, or an alkyl group having a cyclohexyl group[. M], moreover, substituents of the same numeral can either be same or different[.]

Formula (16)

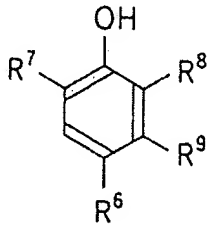


wherein R^{11} is hydrogen or an alkyl group having 1 to 10 carbon atoms.

11. (Amended) A highly stable polymer obtainable by reacting a material polymer having a principal chain including at least a component unit having an acidic functional group and a component unit having a hydroxyl group with an isocyanate compound, and further reacting the same with an alcohol until an acid anhydride group is substantially completely vanished.

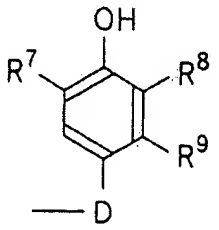
19. (Amended) The highly stable resin according to claim 11, wherein the isocyanate compound is introduced in the principal chain part of the highly stable resin, using a polymerization inhibitor selected from the group consisting of a phenol-based compound represented by the below-mentioned formula (10) and a phosphite-based compound represented by the below-mentioned formula (16):

Formula (10)



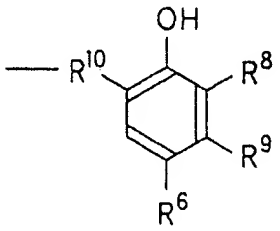
wherein R^6 is hydrogen, an alkyl group having 1 to 5 carbon atoms, or the below-menitoned formula (11):

Formula (11)



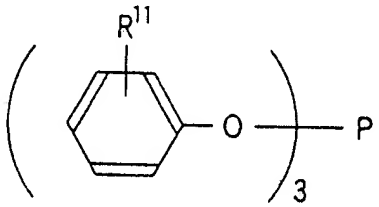
wherein D in the formula (11) is –S-, an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^7 is hydrogen or an alkyl group having 1 to 10 carbon atoms. R^8 is hydrogen, an alkyl group having 1 to 10 carbon atoms, or the below-mentioned formula (12):

Formula (12)



wherein R^{10} in the formula (12) is an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^9 is hydrogen or an alkyl group having 1 to 10 carbon atoms[. H]however, at least one of R^7 and R^8 is a tert-butyl group, or an alkyl group having a cyclohexyl group[. M], moreover, substituents of the same numeral can either be same or different[.],

Formula (16)



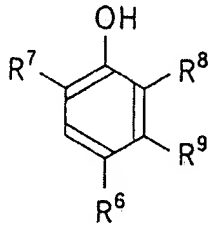
wherein R^{11} is hydrogen or an alkyl group having to 20 carbon atoms.

22. (Amended) A production method for a highly stable polymer comprising the steps of reacting a material polymer having a principal chain including at least a component unit having an acidic functional group and a component unit having a hydroxyl group with an

isocyanate compound, and further reacting the same with an alcohol until an acid anhydride group is substantially completely vanished.

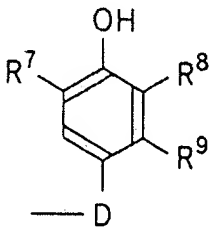
32. (Amended) The production method for a highly stable resin according to claim 22, wherein the isocyanate compound is reacted with the material polymer, using a polymerization inhibitor slected from the group consisting of a phenol-based compound represented by the below-mentioned formula (10) and a phosphite-based compound represented by the below-mentioned formula (16):

Formula (10)



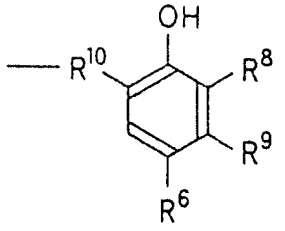
wherein R^6 is hydrogen, an alkyl group having 1 to 5 carbon atoms, or the below-mentioned formula (11):

Formula (11)



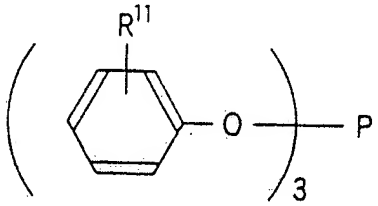
wherein D in the formula (11) is –S-, an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^7 is hydrogen or an alkyl group having 1 to 10 carbon atoms[.], R^8 is hydrogen, an alkyl group having 1 to 10 carbon atoms, or the below:

Formula (12)



wherein R^{10} in the formula (12) is a alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^9 is hydrogen or an alkyl group having 1 to 10 carbon atoms[. H], however, at least one of R^7 and R^8 is a tert-butyl group, or an alkyl group having a cyclohexyl group. Moreover, substituents of the same numeral can either be same or different[.].

Formula (16)



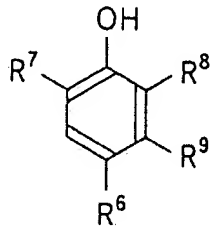
wherein R^{11} is hydrogen or an alkyl group having 1 to 20 carbon atoms.

35. (Amended) A hardenable resin composition containing as the essential component a hardenable polymer obtainable by reacting material polymer having a principal chain including at least a component unit having an acidic functional group and a component unit having a hydroxyl group with an isocyanitc compound having a hardenable reactive group, and further reacting the same with an alcohol until an acid anhydride gropu is substantially completely vanished.

39. The hardenable resin composition according to claim 35, wherein the material polymer is formed by polymerization of a compound having a double bond-containing group and

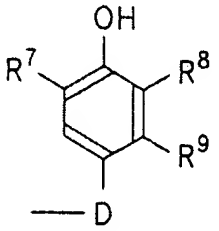
an acidic functional group with a compound having a double bond-containing group and a hydroxyl group, using a non-nitrile azo-based polymerization initiator or a peroxide-based polymerization initiator, and the material polymer is reacted with the isocyanate compound, using a polymerization inhibitor selected from the group consisting of a phenol-based compound represented by the below-mentioned formula (10) and a phosphite-based compound represented by the below-mentioned formula (16):

Formula (10)



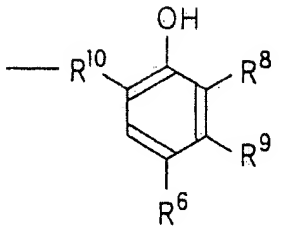
wherein R^6 is hydrogen, an alkyl group having 1 to 5 carbon atoms, or the below-mentioned formula (11):

Formula (11)



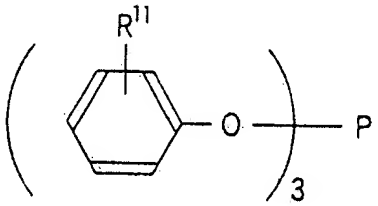
wherein D in the formula (11) is –S-, an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^7 is hydrogen or an alkyl group having 1 to 10 carbon atoms[.], R^8 is hydrogen, an alkyl group having 1 to 10 carbon atoms, or the below-mentioned formula (12):

Formula (12)



wherein R^{10} in the formula (12) is an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^9 is hydrogen or an alkyl group having 1 to 10 carbon atoms[. H], however, at least one of R^7 and R^8 is a tert-butyl group, or an alkyl group having a cyclohexyl group[. M], moreover, substituents of the same numeral can either be same or different[.],

Formula (16)

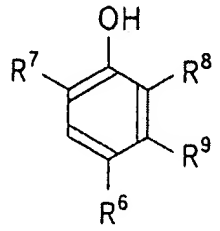


wherein R^{11} is hydrogen or an alkyl group having 1 to 20 carbon atoms.

44. (Amended) The production method for a hardenable resin composition according to claim 42, wherein the material polymer is prepared by polymerization of a compound having a double bond-containing group and an acidic functional group with a compound having a double bond-containing group and a hydroxyl group, using a non-nitrile azo-based polymerization initiator or a peroxide-based polymerization initiator, and the material polymer is reacted with the isocyanate compound, using a polymerization inhibitor selected from the group consisting of

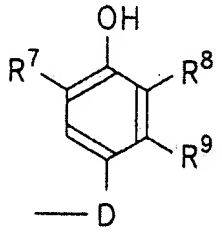
a phenol-based compound represented by the below-mentioned formula (10) and a phosphite-based compound represented by the below-mentioned formula (16):

Formula (10)



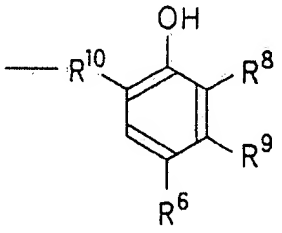
wherein R^6 is hydrogen, an alkyl group having 1 to 5 carbon atoms, or the below-mentioned formula (11):

Formula (11)



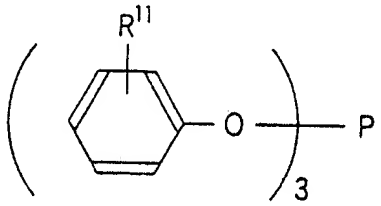
wherein D in the formula (11) is –S-, an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^7 is hydrogen or an alkyl group having 1 to 10 carbon atoms[.], R^8 is hydrogen, an alkyl group having 1 to 10 carbon atoms, or the below-mentioned formula (12):

Formula (12)



wherein R^{10} in the formula (12) is an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^9 is hydrogen or an alkyl group having 1 to 10 carbon atoms[. H], however, at least one of R^7 and R^8 is a tert-butyl group, or an alkyl group having a cyclohexyl group[. M], moreover, substituents of the same numeral can either be same or different[.]

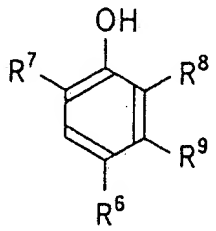
Formula (16)



wherein R^{11} is hydrogen or an alkyl group having 1 to 20 carbon atoms.

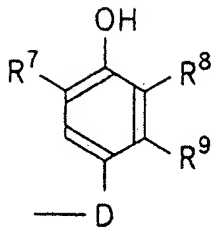
48. (Amended) The production method for a hardenable resin composition according to claim 47, wherein the material polymer is prepared by polymerization of a compound having a double bond-containing group and an acidic functional group with a compound having a double bond-containing group and a hydroxyl group, using a non-nitrile azo-based polymerization initiator or a peroxide-based polymerization initiator, and the material polymer is reacted with the isocyanate compound, using a polymerization inhibitor selected from the group consisting of a phenol-based compound represented by the below-mentioned formula (10) and a phosphite-based compound represented by the below-mentioned formula (16):

Formula (10)



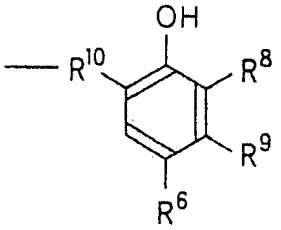
wherein R^6 is hydrogen, an alkyl group having 1 to 5 carbon atoms, or the below-mentioned formula (11):

Formula (11)



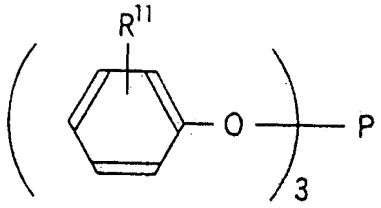
wherein D in the formula (11) is –S-, an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^7 is hydrogen or an alkyl group having 1 to 10 carbon atoms[.], R^8 is hydrogen, an alkyl group having 1 to 10 carbon atoms, or the below-mentioned formula (12):

Formula (12)



wherein R^{10} in the formula (12) is an alkylene group having 1 to 10 carbon atoms or an alkylidene group having 1 to 10 carbon atoms[.], R^9 is hydrogen or an alkyl group having 1 to 10 carbon atoms[. H], however, at least one of R^7 and R^8 is a tert-butyl group, or an alkyl group having a cyclohexyl group[. M], moreover, substituents of the same numeral can either be same or different,

Formula (16)



wherein R^{11} is hydrogen or an alkyl group having 1 to 20 carbon atoms.